

CLAIMS

1. A seismic survey system for use in water, comprising:
 - a source array;
 - an independently steerable deflector device coupled to the source array, wherein the deflector device controls a position of the source array; and
 - a positioning system to determine the location of the source array.
2. The seismic survey system of claim 1, wherein the deflector device controls the position of the source array that trails the independently steerable deflector device.
3. The seismic survey system of claim 1, wherein the deflector device controls the position of the source array that is coupled to a front of the independently steerable deflector device.
4. The seismic survey system of claim 1, wherein the deflector device controls the position of the source array containing the independently steerable deflector device.
5. The seismic survey system of claim 1, further comprising:
wherein the positioning system comprises a positioning unit mounted on the source array.
6. The seismic survey system of claim 5, wherein the positioning system is selected from a global positioning system, an acoustic network, and a laser system.
7. The seismic survey system of claim 5, wherein the positioning system is a satellite positioning system.
8. The seismic survey system of claim 1, further comprising:
a controller for controlling the position of the deflector device.

9. The seismic survey system of claim 8, wherein the desired position is the same position as in a previous seismic survey.
10. The seismic survey system of claim 8, wherein the desired position is a set distance from an edge of a previous seismic survey.
11. The seismic survey system of claim 10, wherein the desired position avoids gaps in coverage.
12. The seismic survey system of claim 8, further comprising:
a positioning unit attached to the source array, wherein the positioning unit provides a signal to inform the controller of a current position of the source array.
13. The seismic survey system of claim 12, wherein a seismic source on the source array is triggered when the source array is at a desired position.
14. The seismic survey system of claim 8, wherein the controller is positioned at a location selected from a towing vessel, the deflector device, and combinations thereof.
15. The seismic survey system of claim 1, wherein the deflector device comprises:
one or more wings; and
a central body, wherein the one or more wings are disposed adjacent to the central body.
16. The seismic survey system of claim 15, wherein the one or more wings are in a generally vertical arrangement.
17. The seismic survey system of claim 15, wherein the one or more wings are in a generally horizontal arrangement.

18. The seismic survey system of claim 15, further comprising:
 - an actuator disposed adjacent the central body, wherein a controller sends a signal to the actuator, and wherein the actuator moves the one or more wings.
19. The seismic survey system of claim 18, wherein the actuator uses a motive force selected from electrical and hydraulic.
20. The seismic survey system of claim 18, wherein the central body and the actuator are made of a material selected from metal, composite and combinations thereof.
21. The seismic survey system of claim 15, wherein the total area of the one or more wings is between about 1 and about 7 square meters.
22. The seismic survey system of claim 15, wherein the upper and lower wings are constructed of a material selected from metal, composite or combinations thereof.
23. The seismic survey system of claim 15, wherein the one or more wings are constructed of a metal skin covering a foam core.
24. The seismic survey system of claim 23, wherein the metal skin is selected from titanium and stainless steel.
25. The seismic survey system of claim 1, wherein the source array comprises one or more sub-arrays and wherein the sub-arrays are coupled to adjacent sub-arrays within the source array by a distance rope.
26. The seismic survey system of claim 1, further comprising:
 - a second independently steerable deflector device coupled to a second source array for controlling a second position of the second source array.

27. The seismic survey system of claim 1, further comprising:
 - an acoustical transducer and receiver coupled to the source array; and
 - a controller, wherein the controller adjusts the deflector device to steer clear of an obstruction located by the acoustical transducer and receiver.
28. The seismic survey system of claim 27, wherein the acoustical transducer and receiver operate in a range typical for sonar devices.
29. The seismic survey system of claim 27, wherein the obstruction is selected from the group consisting of installed constructions, moored devices, floating devices, lead-in cables, umbilicals, towed equipment and combinations thereof.
30. The seismic survey system of claim 27, wherein the acoustic transducer and receiver are pointed in a given direction.
31. The seismic survey system of claim 27, wherein the acoustic transducer and receiver sweeps in many directions.
32. A method of positioning a source array in tow behind a vessel, comprising:
 - determining the position of the source array; and
 - independently steering a deflector device coupled to the source array to move the source array to a desired position.
33. The method of claim 32, wherein the deflector device is coupled to a front end of the source array.
34. The method of claim 32, wherein the deflector device is coupled to a back end of the source array.

35. The method of claim 32, wherein the deflector device is coupled within the source array.
36. The method of claim 32, wherein the step of determining the position further comprises:
determining the position of the source array.
37. The method of claim 32, further comprising:
controlling the deflector device to steer the source array to the desired position.
38. The method of claim 37, wherein the desired position is a same position as in a previous seismic survey.
39. The method of claim 37, wherein the desired position is a set distance from an edge of a previous seismic survey.
40. The method of claim 39, wherein the desired position avoids gaps in coverage.
41. The method of claim 37, further comprising:
determining the position of the source array,
providing the position to the controller.
42. The method of claim 41, further comprising:
triggering a seismic source on the source array when the source array is at a desired position.
43. The method of claim 37, wherein the deflector device comprises:
one or more wings;
a central body; and
an actuator disposed within the central body, wherein the one or more wings are disposed adjacent to the central body.

44. The method of claim 43, further comprising:
 - transmitting a control signal to the actuator;
 - moving the one or more wings with the actuator, wherein the movement of the one or more wings steers the source array.
45. The method of claim 44, wherein the actuator uses a motive force selected from electrical and hydraulic.
46. The method of claim 43, wherein the central body and the actuator are made of stainless steel.
47. The method of claim 43, wherein the total surface area of the one or more wings is between about 1 and about 7 square meters.
48. The method of claim 43, wherein the one or more wings are constructed of a material selected from metal, composite or combinations thereof.
49. The method of claim 43 wherein the one or more wings are constructed of a metal skin covering a foam core.
50. The method of claim 49, wherein the metal skin is selected from titanium and stainless steel.
51. The method of claim 32, wherein the source array comprises one or more sub-arrays, the method further comprises:
 - coupling the sub-arrays to adjacent sub-arrays within the source array with distance ropes.
52. The method of claim 32, further comprising:

coupling a second independently steerable deflector device to a second source array for controlling a second position of the second source array.

53. The method of claim 32, further comprising:

detecting acoustic signals indicating obstructions in the path of the source array; and
adjusting the deflector device to steer clear of an obstruction detected by the acoustical transducer and receiver.

54. The method of claim 53, further comprising:

operating an acoustical transducer and receiver in a range typical for sonar devices.

55. The method of claim 53, wherein the obstruction is selected from the group consisting of installed constructions, moored devices, floating devices, lead-in cables and combinations thereof.

56. The method of claim 55, further comprising:

pointing the acoustic transducer and receiver in a given direction.

57. The method of claim 53, further comprising:

sweeping the acoustic transducer and receiver in many directions.

58. A system for changing the position of a source array towed by a vessel in a body of water comprising:

a deflector coupled to the source array, wherein the deflector includes a wing that provides a lateral force to the source array as the source array is towed through the water;

an actuator for controllably varying the angle between the deflector wing and the direction of water flow;

a sensor for indicating the position of the source array; and

a controller for providing a command to the actuator to vary the angle of attack of the deflector body.

59. The system of claim 58, wherein the command from the controller to the actuator causes the deflector to steer to a desired position.
60. The system of claim 58, wherein the deflector is stabilized against forces transverse to the direction of tow by drag forces resulting from towing the source array from the deflector.
61. The system of claim 60, wherein the deflector is further stabilized against forces transverse to the direction of tow by the deflector having a lower end that is weighted and an upper end that is buoyant.
61. The system of claim 58, wherein the sensor is a satellite positioning system sensor.
62. The system of claim 58, wherein the actuator is selected from a hydraulic actuator, an electrical motor, and combinations thereof.
64. The system of claim 58, wherein the deflector is not supported by a float supporting the source array.
63. A seismic survey system for use in water, comprising:
 - a source array towed by a first tow cable;
 - a deflector deflecting a second tow cable;
 - a distance rope coupling the first tow cable to the second tow cable; and
 - a winch attached to the distance rope, wherein the winch adjusts a length of the distance rope to modify a position of the source array.
64. The seismic survey system of claim 63, further comprising:
 - a positioning system unit mounted on the source array.
65. The seismic survey system of claim 63, further comprising:

a controller for controlling the position of the source array.

66. The seismic survey system of claim 65, wherein the position is the same position as in a previous seismic survey.

67. The seismic survey system of claim 65, wherein the position is a set distance from an edge of a previous seismic survey.

68. The seismic survey system of claim 67, wherein the position avoids gaps in coverage.

69. The seismic survey system of claim 65, further comprising:

a positioning system unit attached to the source array, wherein the positioning system unit provides a signal to inform the controller of the position of the source array.

70. The seismic survey system of claim 69, wherein a seismic source on the source array is triggered when the source array is at a desired location.

71. The seismic survey system of claim 66, wherein the controller is positioned at a location selected from a towing vessel, the winch, and combinations thereof.

72. The seismic survey system of claim 63, wherein the winch comprises:

- a reel for winding the distance rope onto the winch;
- an actuator for rotating the reel; and
- a housing adjacent to the reel.

73. The seismic survey system of claim 72, wherein the actuator uses a motive force selected from electrical and hydraulic.

74. The seismic survey system of claim 72, wherein the housing and the actuator are made of stainless steel.

75. The seismic survey system of claim 63, further comprising:
 - an acoustical transducer and receiver coupled to the source array; and
 - a controller, wherein the controller adjusts the winch to steer clear of an obstruction located by the acoustical transducer and receiver.
76. The seismic survey system of claim 75, wherein the acoustical transducer and receiver operate in a range typical of sonar equipment.
77. The seismic survey system of claim 75, wherein the obstruction is selected from the group consisting of installed constructions, moored devices, floating devices, lead-in cables and combinations thereof.
78. The seismic survey system of claim 75, wherein the acoustic transducer and receiver are pointed in a given direction.
79. The seismic survey system of claim 75, wherein the acoustic transducer and receiver sweeps in many directions.